BONNEVILLE POWER ADMINISTRATION

Johnson Creek Artificial Propagation Enhancement Project Operations and Maintenance Program

2004 Johnson Creek Adult Chinook Salmon Run Report

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JOHNSON CREEK ARTIFICIAL PROPAGATION ENHANCEMENT PROJECT
OPERATIONS AND MAINTENANCE PROGRAM

2004 JOHNSON CREEK
ADULT CHINOOK SALMON RUN REPORT

Period Covered: June 2004 through December 2004

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ABSTRACT

The Nez Perce Tribe, through funding provided by the Bonneville Power Administration, has implemented a small scale chinook salmon supplementation program on Johnson Creek, a tributary in the South Fork of the Salmon River, Idaho. The Johnson Creek Artificial Propagation Enhancement project was established to enhance the number of threatened Snake River spring/summer chinook salmon (*Oncorhynchus tshawytscha*) returning to Johnson Creek to spawn through artificial propagation.

This was the sixth season of adult chinook broodstock collection in Johnson Creek following collections in 1998, 2000, 2001, 2002, and 2003. Weir installation was completed on June 21, 2004 with the first chinook captured on June 22, 2004 and the last fish captured on September 6, 2004. The weir was removed on September 8, 2004. A total of 338 adult chinook, including jacks, were captured during the season. Of these, 211 were of natural origin, 111 were hatchery origin Johnson Creek supplementation fish, and 16 were adipose fin clipped fish from other hatchery operations and therefore strays into Johnson Creek. Over the course of the run, 57 natural origin Johnson Creek adult chinook were retained for broodstock, transported to the South Fork Salmon River adult holding and spawning facility and held until spawned. The remaining natural origin Johnson Creek fish along with all the Johnson Creek supplementation fish were released upstream of the weir to spawn naturally. Twenty-seven Johnson Creek females were artificially spawned with 25 Johnson Creek males. Four females were diagnosed with high bacterial kidney disease levels resulting in their eggs being culled. The 27 females produced 116,598 green eggs, 16,531 green eggs were culled, with an average eye-up rate of 90.6% resulting in 90,647 eyed eggs. The eggs will be incubated and reared at the McCall Fish Hatchery until the juvenile smolt stage and then released back into Johnson Creek in late March 2006.

ACKNOWLEDGEMENTS

The Johnson Creek Artificial Propagation Enhancement Project would like to thank all of the people and Agencies that contributed to the success of this project. Dave Johnson, Ed Larson, Becky Ashe, Doug Nelson, Carl East, Sarah Aavedal, Ryan Jain, JR Inglis, Rick Orme, and Jason Vogel from the Nez Perce Tribe; Ken Kirkman from the Bonneville Power Administration, which provided the funding for this project; the Northwest Power Planning Council; Dan Herrig and his staff at the USFWS, Lower Snake Compensation Office; Gene McPherson and his staff at the McCall Fish Hatchery, who do most of the rearing of the JCAPE fish; Rodney Duke and his crews for CWT and VIE tagging; Herb Pollard from the National Marine Fisheries Service; Doug Munson, Doug Burton, and Tom Rogers from Idaho Fish and Game; and the many other individuals whom we cannot remember at this time that assisted on this project either directly or indirectly.

INTRODUCTION

This report details the results from the brood year (BY) 2004 adult summer chinook salmon (*Oncorhynchus tshawytscha*) trapping, holding, spawning, and incubation through eye-up activities associated with the Johnson Creek Artificial Propagation Enhancement (JCAPE) project. Monitoring and Evaluation (M&E) activities associated with the JCAPE project for the 2004 adult brood year are detailed in a separate report. The JCAPE project is managed by the Nez Perce Tribe's (NPT) Department of Fisheries Resource Management (DFRM) and funded by the Bonneville Power Administration (BPA).

BACKGROUND

The Johnson Creek summer chinook salmon population has experienced significant declines in population numbers over the past five decades. Escapement levels in Johnson Creek have declined from a recorded high of 486 redds in 1960 to a low of five redds observed in 1995. Due to critically low abundance of summer chinook salmon in Johnson Creek, the Nez Perce Tribe, through funding provided by the Bonneville Power Administration, initiated the development of an artificial propagation enhancement project for Johnson Creek in 1996. This decision resulted from a number of factors including: increased emphasis on wild/natural production and stock recovery; consultation and requirements resulting from listing of Snake River chinook populations as threatened under the ESA; and preferred strategies for use of artificial propagation identified in *Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon* (CRITFC 1995).

The Nez Perce Tribe, as the lead fisheries management agency for the JCAPE project, submitted an Endangered Species Act (ESA) Section 10 Permit Application (Lothrop 2000) to the National Oceanic and Atmospheric Administration (NOAA), formerly known as National Marine Fisheries Service (NMFS), for the purpose of supplementing the Johnson Creek chinook salmon population. NOAA Fisheries gave approval for the JCAPE project to capture returning adult salmon in Johnson Creek for the purpose of broodstock collection and subsequent rearing and release of their progeny back into Johnson Creek. The JCAPE project is allowed to rear up to 100,000 smolts per year through this approval.

An annual agreement with the United States Fish and Wildlife Service, Lower Snake River Compensation Plan Office (LSRCP) and the Idaho Department of Fish and Game (IDFG), provides space for the JCAPE project to rear up to 100,000 Johnson Creek smolts at the existing McCall Fish Hatchery. In addition, the JCAPE project holds and spawns Johnson Creek adult broodstock at the South Fork Salmon River (SFSR) adult trapping and spawning facility that is associated with the McCall Fish Hatchery.

DESCRIPTION OF PROJECT AREA

Johnson Creek headwaters are near Deadwood Summit at an elevation of about 7,200 feet and flows northward approximately 35 miles to its confluence with the East Fork South Fork Salmon River near the community of Yellowpine at an elevation of 4,500 feet (Figure 1). Elevations range from 4,500 to 8,500 feet. The subbasin area is 153,800 acres, primarily National Forest land with some private holdings. Over half of the subbasin is inventoried as roadless area. The predominant vegetation is mixed conifer forest with interspersed grass and sedge meadows. The upper one-third of the Johnson Creek subbasin has extensive meadow areas, the middle one-third is characterized by steep cascading sections, and the lower one-third of the subbasin is lower gradient and located in a wide-bottomed valley. Most of the historic and current chinook salmon spawning and rearing has been observed in this lower section (NOAA Fisheries 2004 draft). Runoff is characterized by high flows (2,000 - 5,000 cfs) in the spring followed by a decreasing hydrograph with the lowest flows (80 - 100 cfs) typically in early fall through late winter. Mean annual precipitation varies from between 15 and 58 inches. Most of this precipitation falls in the form of snow from October through April. Summer temperatures can reach near 100 at the lowest elevations, while winter lows are often well below zero (USFS 1995, USFS 1990).

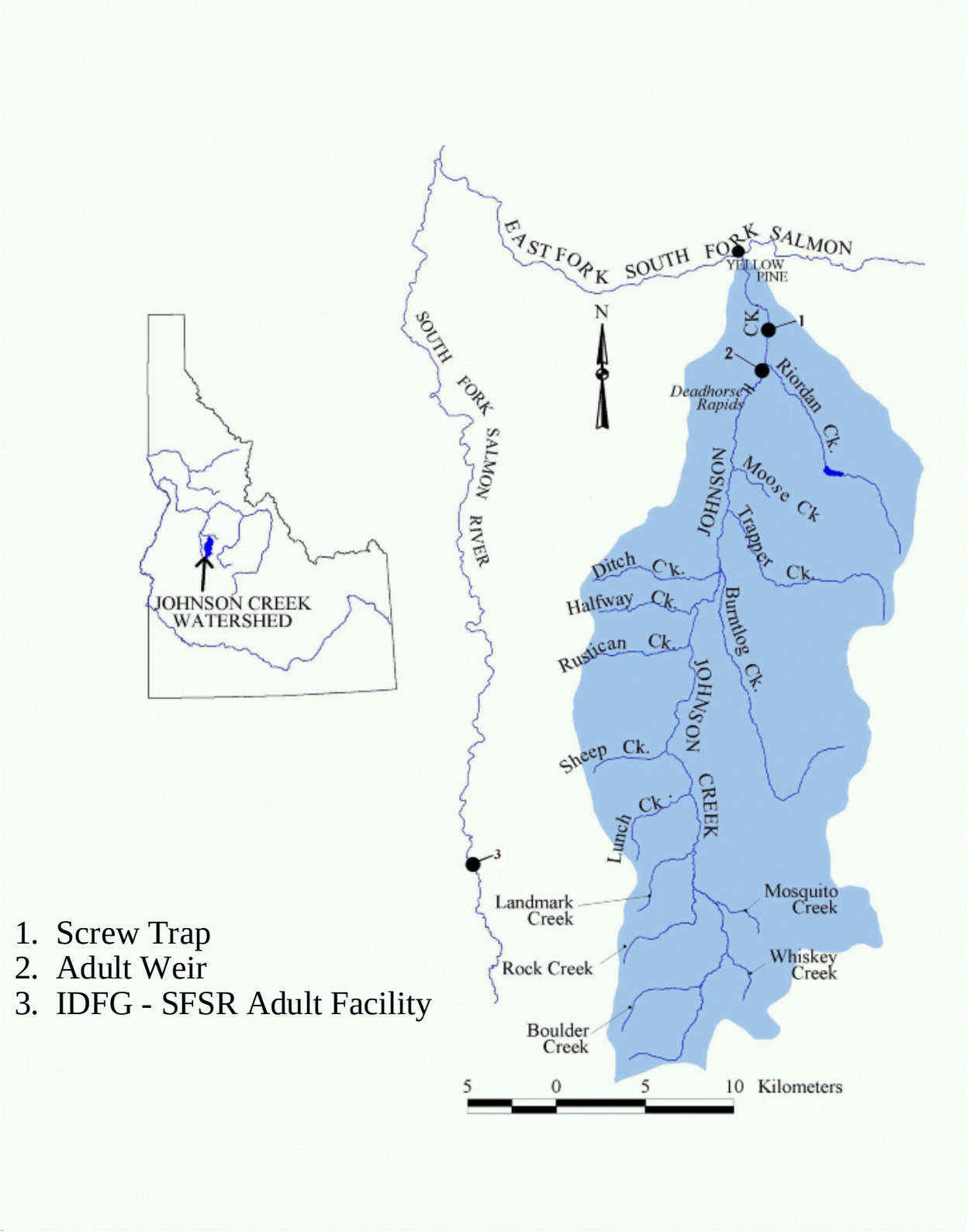

Figure 1: Map of Johnson Creek Watershed and JCAPE Sites

ADULT ESCAPEMENT AND TAKE ESTIMATES

The JCAPE project can rear up to 100,000 Johnson Creek smolts at the McCall Fish Hatchery (MFH). This level of production requires eggs from approximately 32 females. The NOAA Fisheries draft section 10 permit allows up to 40 males and 40 females to be collected and retained for broodstock. In the previous five years of trapping, brood stock was retained across the spectrum of the run based on a ratio of the escapement estimate. However, in three of the five previous years female broodstock taken from the first half of the run have accounted for 100% of the female pre-spawn mortality and in four of those years male broodstock from the first half of the run accounted for over 60% of the male pre-spawn mortality. In an attempt to minimize pre-spawning mortality, it was decided that 33% of the broodstock would be retained from the first half of the run and 67% from the second half of the run. The take of broodstock would also be spread out over each half of the run.

Adult escapement to Johnson Creek in 2004 was estimated to be about 760 and 940 fish. The supplementation portion of this estimate is based on the single smolt to adult ratio (SAR) achieved by BY 1998 Johnson Creek supplementation fish. The natural fish portion of the estimate is based on BY 1997 and BY 1998 Johnson Creek natural fish SAR and the estimated number of Johnson Creek juvenile emigrants from BY 1999, 2000, and 2001. The escapement estimate is adjusted as PIT tags are detected at each dam from adults on the upriver migration.

WEIR INSTALLATION

Adult trapping activities occurred in Johnson Creek approximately 4.5 miles above the confluence of the East Fork of the South Fork of the Salmon River (Figure 1). This is the same location used in prior years. The weir was located on privately owned property of the Bryant Ranch, and was used in agreement with the owners of the property. The Bryant Ranch is located on both sides of Johnson Creek.

The weir was installed as soon as water flows allowed. JCAPE personnel have determined that 700 cfs is the maximum flow allowing for safe and efficient weir installation. Average water year conditions were observed in 2004 and the weir was installed on June 21 at approximately 700 cfs.

The Johnson Creek weir is a temporary picket weir consisting of an in-stream trap box with wings that angle downstream to either shore (Figure 2). The weir wings block upstream passage of adult chinook salmon and funnel them into the trap box. The trap box is an aluminum framework filled with the same style of pickets used in the weir wings. The dimensions of the trap box are approximately 8’x 8’x 8’. A downstream trap box was installed on the west side weir wing to trap downstream migrating fish. This trap box was constructed of the same materials as the upstream trap box and was 4’ x 8’ x 8’.

Figure 2: Johnson Creek Weir

Picket braces installed in the weir during the 2003 trapping season were effective in reducing adult chinook mortality due to gilling between pickets. Picket braces were added to additional weir sections for the 2004 trapping season to include three sections on the east weir wing and five sections on the west weir wing. Upper picket braces were also added to these sections because the 7 foot pickets were replaced with 10 foot pickets.

A PIT tag antenna was installed on the upstream trap entrance. The PIT tag receiver, battery, and solar charger were mounted on the plywood trap entrance cover. This was done to back up the manual PIT tag scanning done while processing fish. This system detected four PIT tags that were missed while processing fish. Personnel later matched three of the four PIT tags to individual fish. This system experienced periods of down time due to power supply failure, this will be corrected for the 2005 trapping season.

On a daily basis, all fish collected by the weir were individually netted out of the holding box and placed in a 30 gallon anesthetizing tub. The anesthetizing agent was Tricane Methane Sulfunate (MS-222) at a concentration of 90 mg/l. Once anesthetized, each fish was examined for fin clips, punches, and other external tags, then the following biological data was collected from each fish: sex, fork length, mid eye to hyperle length, scanned for PIT tags, coded wire tag (CWT), checked for Visual Implant Elastomer (VIE) tags, and a genetic sample collected. All adult salmon, other than jacks, were injected with erythromycin 200 as a prophylactic treatment for bacterial kidney disease (BKD). A sequentially numbered opercle tag was applied to each fish, and then the fish was either released above the weir or selected as broodstock and transported to the SFSR.

Johnson Creek broodstock are held in the same holding ponds as the SFSR broodstock. The opercle tags marking the Johnson Creek broodstock are not always retained at 100% through the spawning season. Therefore, the Johnson Creek broodstock are secondarily marked with a numbered floy tag to ensure identification from SFSR broodstock and to track individual fish through spawning.

ADULT TRAPPING

The first adults were captured on June 22, the day after weir installation. The last adult was captured on September 6 and, trap removal began September 8. A total of 338 chinook were captured in 2004. Of these, 211 (62.4%) were unmarked natural fish, 111 (32.8%) were CWT and/or VIE marked supplementation fish, and 16 (4.8%) were adipose fin clipped fish indicating they were strays from other hatchery programs (Table 1). During JCAPE M&E spawning ground carcass surveys upstream of the weir, six (four females, and two jacks) of the 93 carcasses sampled did not have opercle tags, staple marks, or DNA sample punch holes in the caudal fin. Only five of the 93 (5.4%) carcasses were unmarked. These fish most likely migrated upstream of the weir site prior to installation or got through or over the weir after installation.

Table 1: Adult Trapping Summary

	Natural Adults	Supplementation Adults	Stray Adults	Total
Jacks	23	35	0	58
Males	92	38	7	137
Females	96	38	9	143
Total	211	111	16	338

Thirty-three adult chinook were trapped in the downstream trap box at the weir and were released downstream of the weir. Five of the 33 were unmarked fish that potentially migrated above the weir prior to weir installation or had shed their tag. Twenty-one of the 33 chinook that passed through the downstream trap box were recaptured in the upstream trap, one on multiple occasions. Five chinook made two trips through the downstream box, four of these stayed below the weir and one was captured in the upstream trap three times and eventually stayed above the weir. Movement of chinook using the downstream trap saw 16 chinook migrating below the weir. Species other than adult chinook trapped in the downstream trap box were enumerated and released downstream of the weir without marking so recapture in the upstream trap was unknown.

In addition to adult chinook salmon, adult steelhead trout (*Oncorhynchus mykiss)*, bull trout (*Salvelinas confluentus*), and mountain whitefish (*Prosopium williamsoni*) were also captured. One adult male steelhead was captured in 2004 with a fork length of 77cm. The steelhead was a post spawn fish migrating down river and caught and released from the downstream trap box. Twenty-three bull trout and 41 whitefish were captured and released upstream. Twelve bull trout and seven whitefish were captured in the downstream trap and released downstream. Bull trout ranged from 39 to 59 cm fork length. Whitefish ranged from 23 to 36 cm fork length. There were no cutthroat trout (*Oncorhynchus clarki*) captured in 2004.

RUN TIMING

The first chinook was captured on June 22 and the last fish on September 6. The 2004 run timing was bi-modal and is similar to what has been observed over the last several seasons (Figure 3). The first peak occurred in mid July, shortly after trapping began. The second peak occurred in mid to late August during spawning. The August peak is similar to what was observed in 1998, 2000, 2001, 2002, and 2003 (Daniel and Gebhards 2003; Hill et al 2004). July 6 was the largest day of trapping with 23 chinook trapped. August 7 is typically the beginning of spawning activity in Johnson Creek. Fifty-three percent of the run had passed through the trap by this date. As mentioned earlier, 5 fish were found without tags during carcass surveys upstream of the trap location. It is possible that these fish migrated upstream prior to weir installation.

Figure 3 illustrates run timing, water temperature, and stream flow during the period that the adult trap was operated in Johnson Creek. Figure 4 illustrates the run timing of natural fish versus supplementation fish into the Johnson Creek weir. In 2004, there appeared to be no difference in run timing other than the slight time lag of supplementation fish at the beginning of the run. Figure 5 illustrates the run timing of natural fish versus supplementation fish (excluding jacks) and indicates a slight time lag of supplementation fish at the beginning of the run.

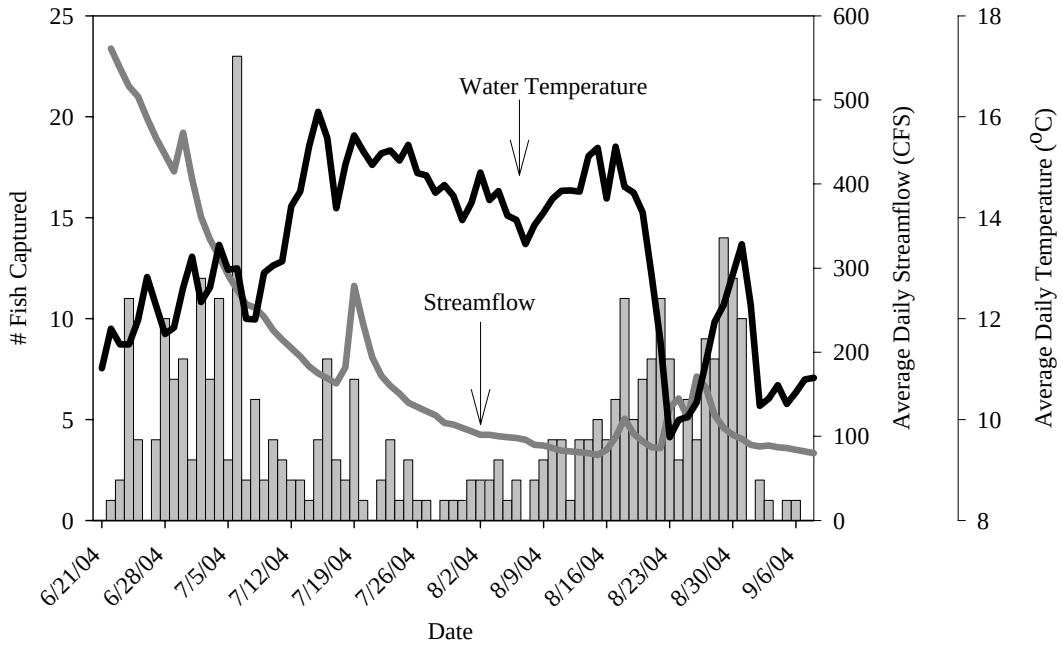

Figure 3: Run Timing, Water Temperature, and Stream Flow

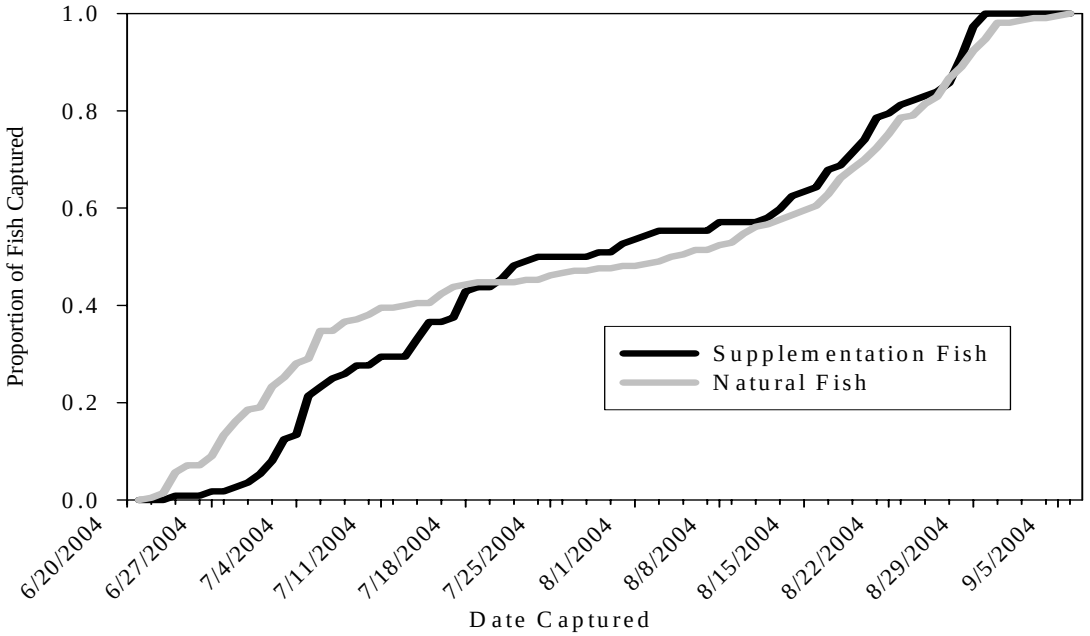

Figure 4: Run Timing of Natural and Supplementation Fish

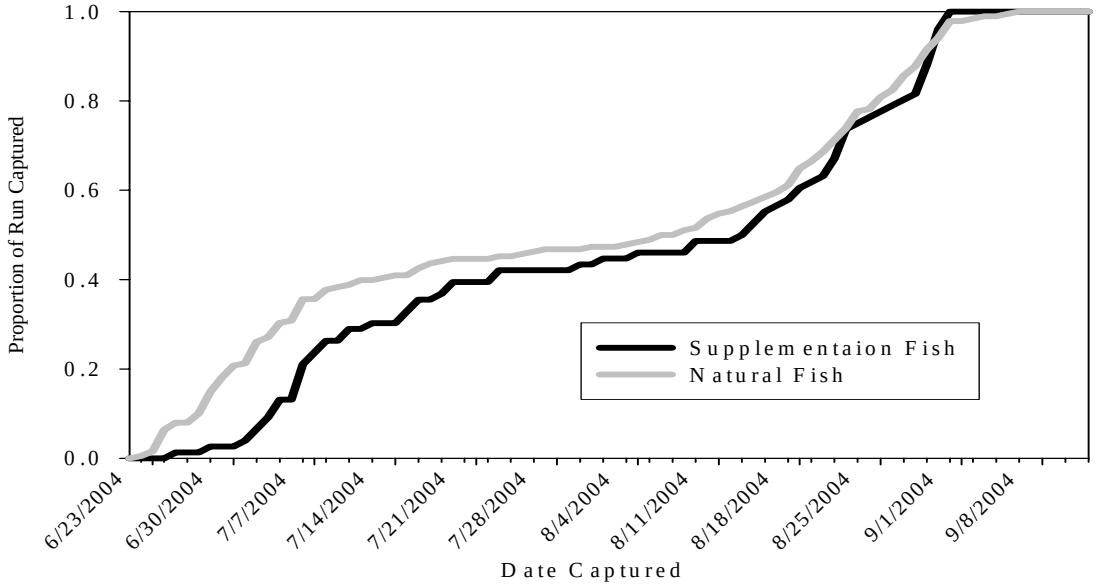

Figure 5: Run Timing of Natural and Supplementation Fish (No Jacks)

LENGTH AND AGE SUMMARIES

Age class determination for Johnson Creek adult chinook have been adopted from average historical SFSR length at age data (Age 3 < 67 cm ≥ Age 4 < 90 cm ≥ Age 5). These categories were used to classify age of unmarked natural fish until length at age categories specific to Johnson Creek can be developed. Supplementation fish are marked or tagged as juveniles in a manner that identifies their age and are classified accordingly. Using the length and age thresholds developed in the SFSR, the 2004 Johnson Creek adult run, excluding strays, was comprised of 18.0% age 3, 76.7% age 4, and 5.3% age 5 (Table 2 and Figure 6). There were no age 5 supplementation returns to Johnson Creek in 2004 because there were no trapping and spawning operations in 1999.

Table 2: Age Class Summary

Age and Sex		Natural Adults	Supplementation Adults	Stray Adults	Total by Age and Sex	Total by Age
Age 3	Male	23	35	0	58	58
Age 4	Male	87	38	7	132	262
	Female	84	38	8	130	
Age 5	Male	5	-	0	5	18
	Female	12	-	1	13	
Total		211	111	16	338	338

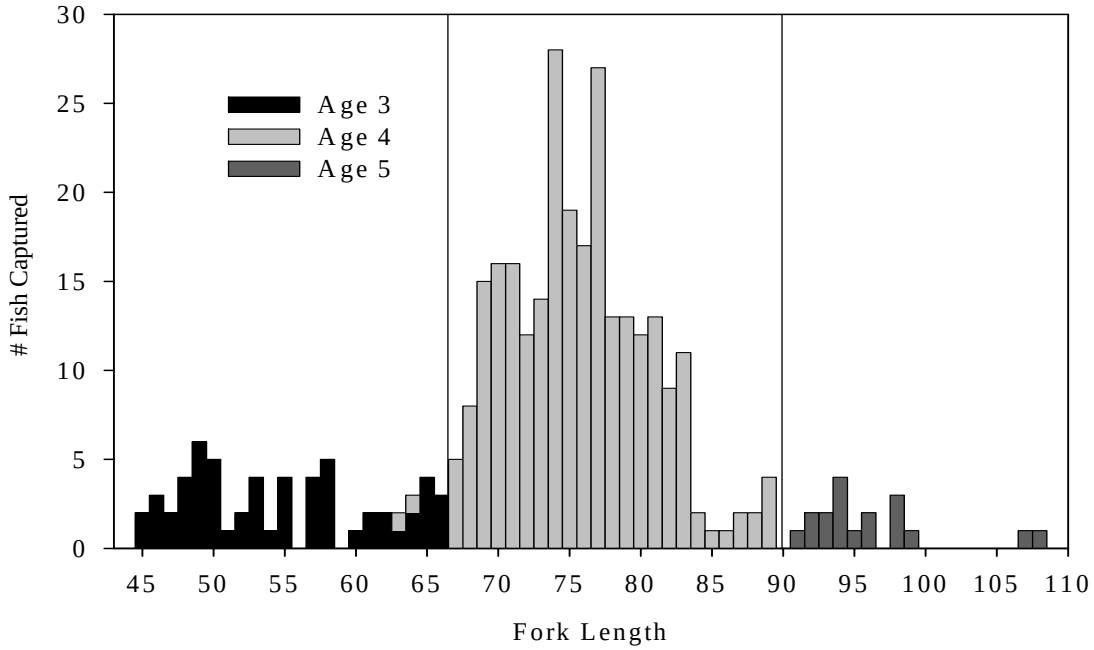

Figure 6: Johnson Creek Adult Chinook Length Frequency

Figure 7 illustrates the length frequency of known age natural and supplementation fish based on VIE and PIT tags detected in Johnson Creek in 2004. Most PIT tagged fish along with VIE tagged (VIE only or VIE and CWT) supplementation fish are included. Natural origin PIT tagged fish with a length at the time of tagging not definitely correlated with a certain brood year were not used. Supplementation fish with CWT only cannot be used until the CWT results have been compiled. The age identifying tags detected in 2004 and used here were natural origin age 4 PIT tags, age 3 and age 4 supplementation PIT tags, and supplementation age 3 and age 4 VIE only or VIE and CWT. Based on length at age categories used for age classifications, there is an overlap of known age 4 fish below the length threshold value (2.7% of 75). None of the known age 4 fish were above the 90cm threshold and, none of the known age 3 fish were above the 67cm threshold for age 4. In previous years, other known age fish have exhibited this same age threshold overlap pattern. Attempts to use a single set of length at age threshold for age classification will continue to misclassify the actual age of some unmarked fish. Continued recalibration of the length at age threshold based on known age fish will help reduce this overlap. However, short of definitively aging each fish each year, length at age thresholds will be the best method available for classifying the age of unmarked fish during the entire run as a whole.

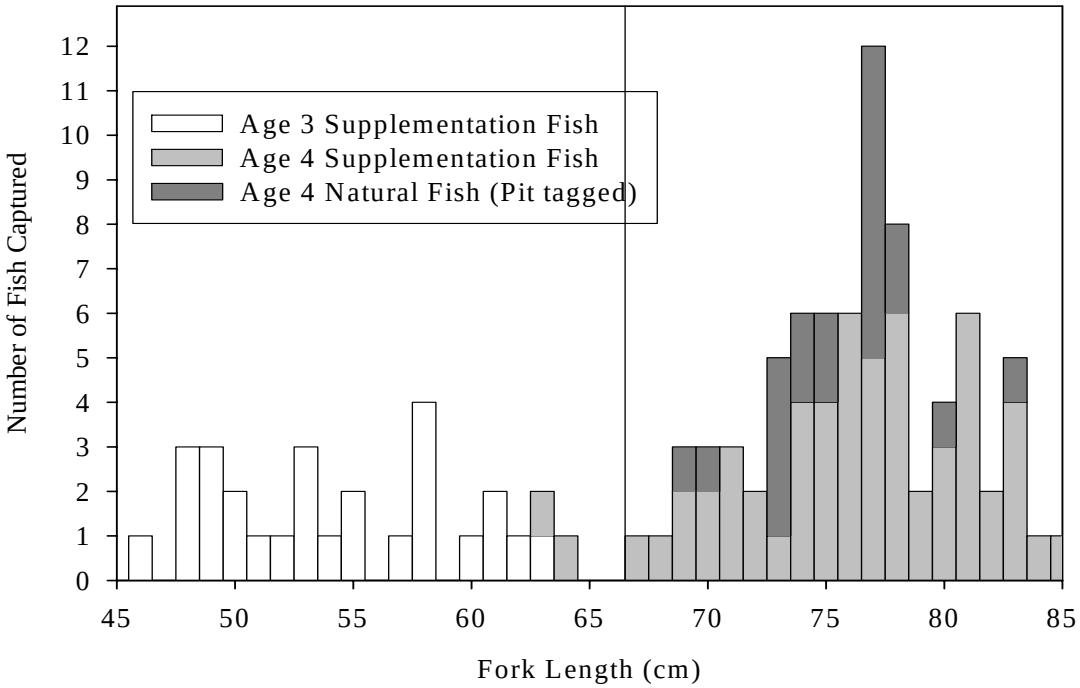

Figure 7: Johnson Creek Adult Known Age Length Frequency

TAG AND MARK DETECTION

Adipose (AD) fin clips, PIT tags, VIE tags, and CWT were detected at the Johnson Creek adult weir (Table 3). All AD fin clipped fish were hatchery fish released from other populations, most likely from the SFSR, and were not of Johnson Creek origin. CWT analysis from snouts collected from mortalities at the weir or carcasses from spawning ground surveys indicate that 10 of the CWT codes were from JCAPE supplementation releases and 3 were from out of basin strays (1 Grande Ronde fish and 2 Rapid River fish).

Table 3: Summary of Tag and Mark Detections

Age and Sex	PIT Tag	CWT Tag No VIE No AD	VIE Tag No CWT No AD	CWT and VIE	AD Only	AD and CWT
Age 3 (Jack)	5	8	0	27	0	0
Age 4 Male	19	11	0	27	5	2
Age 4 Female	16	7	3	28	7	1
Age 5 Male	0	0	0	0	0	0
Age 5 Female	0	0	0	0	1	0
Total	40	26	3	82	13	3

There were 40 fish identified at the adult trap as being PIT tagged in 2004, ten were supplementation fish and 30 were natural fish (Table 3). An additional PIT tag was detected by the remote detector on the trap entrance but was not matched up to an individual fish.

Of the 111 supplementation fish returning to Johnson Creek in 2004, 35 were age 3 and 76 were age 4. Eighty-two of the 111 (73.9%) supplementation fish retained both the CWT and the VIE tags, three (2.7%) were VIE tagged only and, 26 (23.4%) were CWT only (Table 3). The 13 AD fin clip only and 3 AD fin clip and CWT fish were strays from other hatchery programs. No supplementation releases occurred from BY 1999 therefore, there were no age 5 supplementation returns in 2004.

Johnson Creek supplementation fish are all marked with CWT and VIE tags as parr. These fish are not AD fin clipped to minimize potential fishery impacts. Tag retention rates for CWT and VIE are checked in January during the pre-smolt PIT tagging process. In March 2002, 57,392 BY 2000 Johnson Creek smolts were released back into Johnson Creek. Based on pre-release CWT and VIE tag loss rates, 57,317 of these fish were tagged with either CWT, VIE or both (CWT loss rate = 3.47%, VIE loss rate = 1.91%, loss rate of both CWT and VIE = 0.13%) (Table 4). Post release CWT loss rates increased in 2003 for BY 2000 but declined in 2004, while post release tag loss rate for VIE tags have increased in both years for BY 2000 (Table 4).

Table 4: Tag Detections and Tag Loss BY 2000 Adult Returns

Age	Return Year	Number Of Supplementation Adults Returning			Total Supplementation Adult Return	Percent Tag Loss		Probability of Tag Loss of Both CWT and VIE	Potential Number of Fish Misclassified as Natural
		CWT Only	VIE Only	CWT and VIE		CWT	VIE		
Smolt	2002[1]				57,392[2]	3.47%[3]	1.91%[3]	0.13%[3]	
3	2003	11	4	50	65	6.15%	16.92%	1.04%	0.68
4	2004	18	3	55	76	3.95%	23.68%	0.94%	0.71
Total Adults		29	7	105	141	4.96%	20.57%	1.02%	1.44

1- Release Year
2- Number of smolts released
3- Actual number observed during PIT tagging

In March 2003, 73,000 BY 2001 Johnson Creek smolts were released back into Johnson Creek. Based on pre-release CWT and VIE tag loss rates, all 73,000 of these fish were tagged with either CWT, VIE or both (CWT loss rate = 0.31%, VIE loss rate = 1.17%, loss rate of both CWT and VIE = 0.0%) (Table 5). Post release tag loss rates for the first adult return year of BY 2001 showed a decrease for CWT and an increase for VIE tags (Table 5). If tag loss rates increase, the potential exists for some returning supplementation fish to be classified as natural fish.

Table 5: Tag Detections and Tag Loss BY 2001 Adult Returns

Age	Return Year	Number Of Supplementation Adults Returning			Total Supplementation Adult Return	Percent Tag Loss		Probability of Tag Loss of Both CWT and VIE	Potential Number of Fish Misclassified as Natural
		CWT Only	VIE Only	CWT and VIE		CWT	VIE		
Smolt	2003[1]				73,000[2]	0.31%[3]	1.17%[2]	0.0%[3]	0.0
3	2004	8	0	27	35	0.0%	22.86%	0.0%	0.0

1- Release Year
2- Number of smolts released
3- Actual number observed during PIT tagging.

FISH DISPOSITION AND ADULT HOLDING

Adult chinook captured at Johnson Creek were either: 1) released upstream for natural spawning; 2) selected as broodstock and transported to the SFSR (natural fish only); 3) released downstream if captured in the downstream trap; or 4) euthanized and placed into Johnson Creek for nutrient enhancement (stray AD fin clipped fish only) (Table 6). AD fin clipped fish were euthanized rather than transported back to the SFSR because of an over abundance of AD fin clipped fish at the SFSR facility. In 2001, NOAA Fisheries disallowed the release of any AD fin clipped hatchery stray salmon upstream of the Johnson Creek weir because of the potentially high number of salmon straying into Johnson Creek from the SFSR (Jones 2001). This continued for each trapping season since and included the 2004 season.

Table 6: Fish Disposition

	Released Upstream	Transported to SFSR	Trap Mortalities	Euthanized	Total Trapped
Johnson Creek Jack	56	2	0	0	58
Johnson Creek Male	105	25	0	0	130
Johnson Creek Female	103	30	1	0	134
Fin Clipped Jack	0	0	0	0	0
Fin Clipped Male	0	0	0	7	7
Fin Clipped Female	0	0	0	9	9
Total	264	57	1	16	338

Adults collected for broodstock were transported to the SFSR facility in a 400 gallon transport tank mounted on a one-ton flatbed truck and equipped with an aerator and oxygen supply. The tank was filled with river water prior to trap work up and supplied with oxygen at a rate of approximately 8 liters per minute. Fish were then transported about 35 miles (1.25 hours) to the SFSR facility. The fish were then netted out of the tank and placed into the raceways at the SFSR.

Over the course of the run, 2 jacks, 25 males, and 30 females (natural fish only) were retained for broodstock and transported to the SFSR (Table 6). These fish were then placed into the appropriate male or female holding pond. At first spawning sort, Johnson Creek males were moved to a 16-foot diameter, 5-foot deep circular tank and remained there through the spawning season. Any new Johnson Creek males brought to the SFSR were then placed in the circular tank to keep stocks separated. Johnson Creek females remained in the female SFSR holding pond.

The JCAPE project attempts to retain broodstock that represent the run in general. The run estimate for 2004 was between 760 and 940 fish. In an attempt to reduce pre-spawn mortality associated with elevated water temperatures at the SFSR, broodstock collection was set to take one third of the broodstock from the first half of the run and two thirds from the second half. Overall, 27% of the natural fish returning to Johnson Creek were retained for broodstock, 39% from the first half of the run and 61% from the second half of the run (Figure 8).

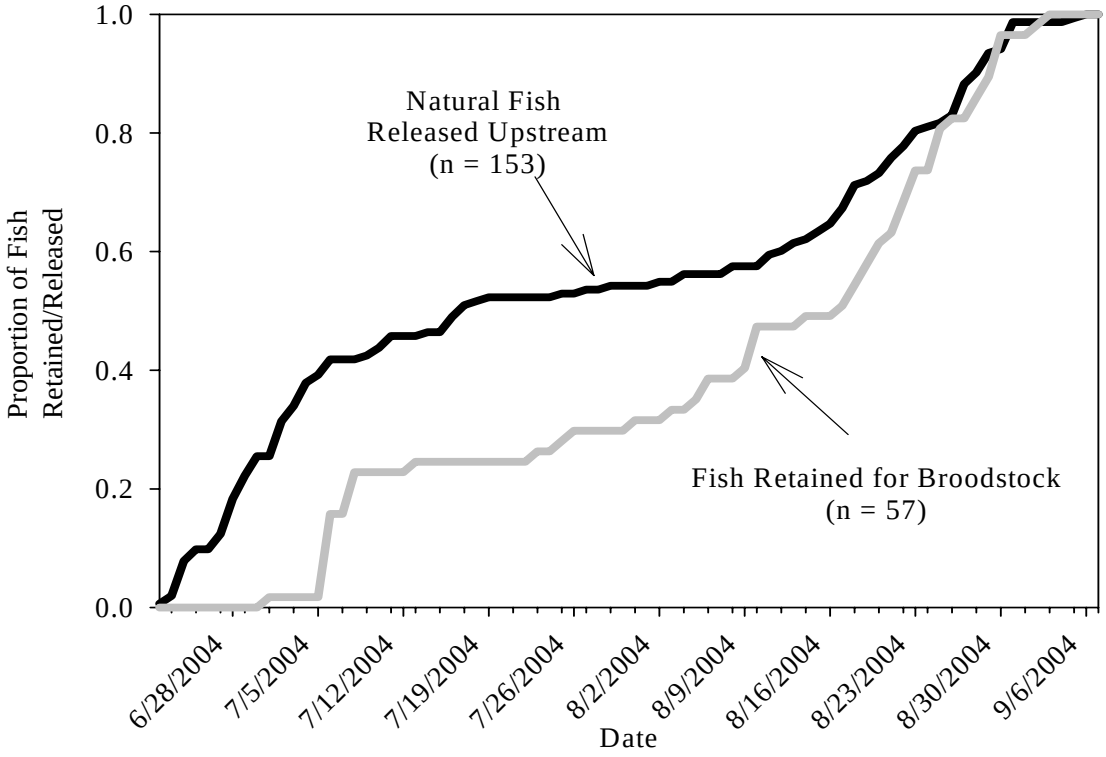

Figure 8: Natural Fish Retained in Proportion to Natural Fish Released

INJURIES AND PRE-SPAWNING MORTALITY

The picket braces installed above and between the stringers have been effective in reducing mortality due to fish wedging themselves between pickets. No mortalities occurred in 2004 due to this problem. There was only one trap mortality recorded in 2004, an age 5 female in the upstream trap box. The cause of death was not determined.

All female salmon transported to the SFSR that did not contribute to the spawn were considered a pre-spawn mortality (PSM). Males that did not contribute to the spawn and died after two weeks of the first spawn date were not considered pre-spawn mortalities. The two male Johnson Creek PSM died within two weeks of the first spawning date. In 2004, the Johnson Creek female PSM rate was 10.0%, male PSM rate was 8.0% and 0.0% for jacks (Table 7). This compares to the 2004 SFSR female pre-spawn mortality of 21.3% and 9.9% for the males including jacks (Table 7). The previous ten-year average pre-spawn mortality at the SFSR is 11.7% for males and 18.3% for females (MFH 1994 - 2003). Table 8 lists the Johnson Creek pre-spawn mortality from the six years of broodstock collection.

Because of high PSM of Johnson Creek broodstock collected from the first half of the run in previous years, broodstock collection from Johnson Creek was changed from collecting evenly across the spectrum of the run to 1/3 from the first half and 2/3 from the second half of the run. Three of the 10 female broodstock collected from the first half of the run were PSM and

accounted for 100% of the 2004 female PSM. One of the 11 male broodstock collected from the first half of the run was a PSM and accounted for 50% of the 2004 male (including jack) PSM.

Table 7: 2004 Johnson Creek Pre-Spawn Mortality (PSM)

	Johnson Creek PSM	Total Transported to SFSR	Percent Johnson Creek PSM	Percent SFSR PSM
Jacks	0	2	0%	
Males	2	25	8%	9.9%
Females	3	30	10%	21.3%
Total	5	57	8.8%	

Table 8: Historical Johnson Creek Pre-Spawn Mortality (PSM)

	Jack PSM		Male PSM		Female PSM		Total PSM	
Brood Year	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1998	0	0%	3	15.0%	2	5.9%	5	9.1%
2000	2	6.3%	1	4.0%	0	0%	3	4.1%
2001	7	46.7%	33	39.8%	22	43.1%	62	41.6%
2002	0	0%	5	9.4%	8	19.1%	13	13.4%
2003	1	33.3%	9	25.7%	16	39.0%	26	32.9%
2004	0	0%	2	8.0%	3	10.0%	5	8.8%
Average		14.4%		17.0%		19.5%		18.3%

SPAWNING

Spawning at the SFSR occurs twice a week, on Tuesdays and Fridays. The first spawning sort occurred on August 13th when every fish was checked for sex and females are checked for ripeness. Johnson Creek males, identified by an opercle tag and/or a floy tag, were transferred from the SFSR male holding pond to the circular holding tank during this sort to streamline the spawning process and reduce handling stress.

Twenty-seven Johnson Creek females were spawned in 2004 on seven spawn days or egg lots (Table 9). Twenty-five different males (two of these were jacks) were spawned with the 27 females. Eggs from 24 individual females were fertilized with a single male each and, three females were spawned with two males each (Table 9). The last spawn day was September 3rd.

After fertilization, eggs from individual females were water hardened, disinfected, and transported in separate egg bags to the MFH. The perforated plastic tubes used in previous years to transport eggs were replaced in 2004 with mesh bags in an attempt to increase green egg to eyed egg survival. Disease samples were taken from each female as they were spawned. All carcasses from spawned out fish or pre-spawn mortalities were returned to Johnson Creek for nutrient enhancement. Twenty-three live males were returned to Johnson Creek after being used as broodstock at the SFSR.

Table 9: Brood year 2004 Spawning and Egg Incubation

Date	Lot	Female ID #	Male ID #	Male ID #	# Green Eggs	# Eyed Eggs	% Eye-Up
8/13/04	1	16	20		4,075	3,355	82.3
		22[1]	19		3,064	2,976	97.1
8/17/04	2	28	23		4,810	3,937	81.9
		29[1]	6		3,882	2,872	74.0
8/20/04	3	12	1		5,250	4,641	88.4
		30[1]	26		4,360	4,060	93.1
		31	18		4,450	4,278	96.1
		35	21		4,813	4,684	97.3
		34	11		4,864	3,710	76.3
		32	4[2]		3,368	3,247	96.4
		24	33		4,480	3,568	79.6
		14	17		4,794	4,317	90.1
8/24/04	4	41	10		3,821	3,604	94.3
		2	38		3,122	2,987	95.7
8/27/04	5	37	45		3,608	3,435	95.2
		47	42		2,897	2,771	95.7
		44	5		3,482	3,224	92.6
		46	36		3,714	2,910	78.4
		8	25		6,231	6,017	96.6
		40[1]	39[2]		5,225	4,771	91.3
		43	38[3]		4,007	3,880	96.8
8/31/04	6	49	50		5,210	4,908	94.2
		48	51		3,996	3,233	80.9
		53	54		6,423	6,064	94.4
		7	5[3]	36[3]	5,712	5,362	93.9
		55	42[3]	45[3]	3,948	3,696	93.6
9/3/04	7	56	52	57	2,992	2,819	94.2
Total		27	25		116,598	105,326	
Average					4,318	3,901	90.3

1 - High Positive BKD
2 - Jack
3 - Previously spawned

PATHOLOGY RESULTS

The IDFG pathology department samples Johnson Creek adult female chinook used as broodstock to test for bacterial kidney disease (BKD), infectious hematopoietic necrosis (IHN), infectious pancreatic necrosis (IPN), and whirling disease (WHD). Seventeen of the 27 females tested positive for BKD, 13 had low optical densities (greater than 0.1 and less than 0.25) and, four had high optical densities (greater than or equal to 0.25) enzyme-linked immunosorbent assay (ELISA) BKD values (Table 10). The 16,531 green eggs from the four high positive females were culled. All other tests were negative for the other pathogens in which tests were conducted.

Prior to 1998, no disease history had been established for the Johnson Creek natural spawning population. Positive BKD results from samples collected in 1998, 2000, 2001, 2002, 2003, and 2004 indicate an existing level of this disease in Johnson Creek (Table 10)(Daniel and Gebhards 2003; Hill et al. 2004). ELISA reagent batches have different sensitivities that determine the threshold levels between negative, low, and high BKD. A different reagent batch was used in 1998 (high BKD > 0.8) than 2000, 2001, 2003, and 2004 (high BKD > 0.25) and 2002 (high BKD > 0.12).

Table 10: BKD Testing Results from Prior Years

Year	Number Tested	Percent Positive	Percent High Positive
1998	32	47%	13%
2000	43	58%	7%
2001	29	52%	7%
2002	34	9%	6%
2003	25	8%	0%
2004	27	63%	15%

EGG INCUBATION AND EYE-UP

Eggs from each female were transported and incubated separately so that they could be culled if BKD levels of the parent female were high. Four of the 27 Johnson Creek females tested high for BKD so their 16,531 green eggs were culled. The other 23 females spawned that tested negative or low for BKD produced 90,647 eyed eggs. Overall egg eye-up rate (including culled eggs) for 2004 was 90.3 % (Table 9). Eye-up rate for SFSR stock in 2004 was 86.2%.

The perforated plastic tubes used to transport individual female's eggs from the SFSR facility to the MFH were replaced with mesh bags for the 2004 season because JCAPE and MFH personnel felt the plastic tubes caused some egg mortality during loading and unloading of eggs from the tubes and during transportation to the hatchery. The 90.3% eye-up rate experienced in 2004 is the highest eye-up rate attained on the Johnson Creek eggs since the project began. Eye-up rates for the previous five years range from 62.0% to 86.0% and average 77.9% (Table 11). The SFSR eye-up rate for 2004 was 86.2% and range from 74.5% to 87.3% and average 82.4% over the same time range expressed for the Johnson Creek eggs (Table 11). No comparison was made

between the egg tubes and the mesh bags so we cannot determine with certainty that the increased eye-up rate was due to the use of the mesh bags.

Table 11: JCAPE Eye-Up Rates 1998 – 2004

Brood Year	JCAPE Eye-up %	SFSR Eye-up %
1998	62.0	80.8
1999	No eggs taken	83.7
2000	86.0	85.2
2001	75.4	74.5
2002	85.9	87.3
2003	80.4	83.1
2004	90.3	86.2
Average	80.0	83.0

CRYOPRESERVATION

Personnel from the NPT Cryopreservation Project (BPA project number: 199703800) collected gamete samples from 60 Johnson Creek males in 2004. Thirty-nine males were sampled from Johnson Creek, 29 at the weir and 10 from the stream. Twenty-one of the Johnson Creek broodstock males at the SFSR were also sampled.

CONCLUSIONS

The sixth season of JCAPE adult trapping went well but not without challenges. Improvements in field operations in 2004 were made because of experience gained in preceding years. These include:

- New 10 foot pickets to replace bent pickets installed on either side of the trap entrance.
- Picket braces added above the upper stringer on the sections with 10 foot pickets.
- Selecting 63% of the broodstock from the second half of the run reduced pre-spawn mortality.
- Transporting eggs from the SFSR facility to the MFH in mesh bags rather than plastic tubes potentially increased eye-up survival.
- Installation of a power transfer switch allows the use of a generator for a dependable backup power supply for the circular tank pump.

Minor improvements that need to be addressed for the 2005 field season include:

- More secure secondary identification tag for adults.

There are many more improvements that can be made to add to the continued success of the JCAPE project. Additional facilities are necessary to conduct field operations properly.

- A permanent trapping facility on Johnson Creek would eliminate many of the problems encountered with the current trapping equipment. Trapping would be more efficient, more fish friendly and easier for NPT personnel to install and operate.
- A permanent holding facility at Johnson Creek would eliminate the need for fish transport thus greatly reducing the amount of stress placed on fish retained for broodstock. Permanent holding would also eliminate problems encountered with temporary holding facilities at the SFSR facility. Johnson Creek females would not have to cohabitate with SFSR females in a foreign water source. Males would not have the added stress of moving from fish truck to raceway to circular holding tank. Many of the dangers of using pumps, pipes, and hoses for providing a temporary water source would be eliminated.

Support and the approval of the agencies governing the activities of JCAPE will continue to be solicited by JCAPE and NPT-DFRM administration. Adaptive management practices will continue to be used to improve the JCAPE project and increase its effectiveness restoring chinook salmon populations in Johnson Creek.

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Appendix A: JCAPE Supplementation Releases and Returns 1998 – 2004

Brood Year [1]	Females Spawned[2]	Males Spawned[2]	Eggs Taken	Eggs Per Female	Green Eggs Culled	%Egg Eye-Up	Number Released	% Egg To Release Survival[3]	Release Year	Males Trapped			Females Trapped			Total BY Return	% Return (SAR)	Total Adult BY Return	% Adult Return (SAR)
										Age 3	Age 4	Age 5	Age 3	Age 4	Age 5				
1998	32	17	155,870	4,871	20,477	62	78,950	58.3	2000	236	233	28	0	159	72	728	0.922	492	0.623
2000	16	25	65,060	4,066	0	86	57,392	88.2	2002	65	38	-	0	38	-	141[4]	0.246[4]	76[4]	0.132[4]
2001	28	50	115,848	4,119	8,733	75.4	73,000	68.2	2003	35	-	-	0	-	-	35[4]	0.048[4]	N/A[4]	N/A[4]
2002	34	44	166,122	4,885	9,601	85.9	14,996[5] 2,388[6] 112,870[7]	96 96.9 83.2	2002 2003 2004										
2003	25	28	126,900	5,076	0	80.4	105,230	82.9	2005										
2004	27	25	116,598	4,318	16,531	90.3													

1 – No Broodstock were collected in 1999, so no supplementation fish will be documented for that brood year.
2 – All male and female broodstock were from wild/natural origin, unless otherwise specified in the report text.
3 – The number of eggs culled is subtracted from number of eggs taken in calculating egg to smolt survival.
4 – Incomplete due to brood year not fully returned.
5 – Eyed egg out-plant on October 22, 2002 of 14,996 eyed eggs.
6 – Fall Pre-smolt release on October 28 and 29, 2003.
7 – Brood year 2002 smolt release on March 15 through 18, 2004.